

Room Temperature Electrolyzers For Oxygen Generation On Mars, Phase I

Completed Technology Project (2018 - 2019)



Project Introduction

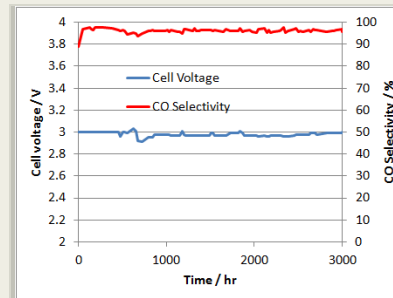
The objective of this proposal is to adapt the CO₂ electrolyzers currently being developed under ARPA-E support to NASA missions. The devices are similar to a solid oxide electrolyzer, in that they can operate on dry CO₂, but the devices use a proprietary polymer rather than a solid oxide to allow them to operate at room temperature (~25 °C). In ARPA-E supported work, we have already demonstrated CO₂ electrolysis for 3000 hours and 95% selectivity under wet conditions and 100 hours with a dry cathode. 5000 hour tests are scheduled shortly. In the proposed work, we will adapt the devices to NASA missions. In particular, we will modify our membranes so they can be run with minimal water, improve strength to allow higher differential pressure operation, and complete the various tests requested in the BAA.

Anticipated Benefits

We think these devices will have three potential NASA applications:

- Oxygen production in Mars
- Improving oxygen recovery on the ISS or in other manned space craft.
- As an energy storage device.

Dioxide Materials and our partners at 3M are interested in pursuing two different opportunities: small electrolyzers as CO₂ sensors in HVAC systems and fire detection modules, and large electrolyzers as a way of recycling CO₂ back to fuels and chemicals, as a way of lowering chemicals cost and as a way of reducing global warming.



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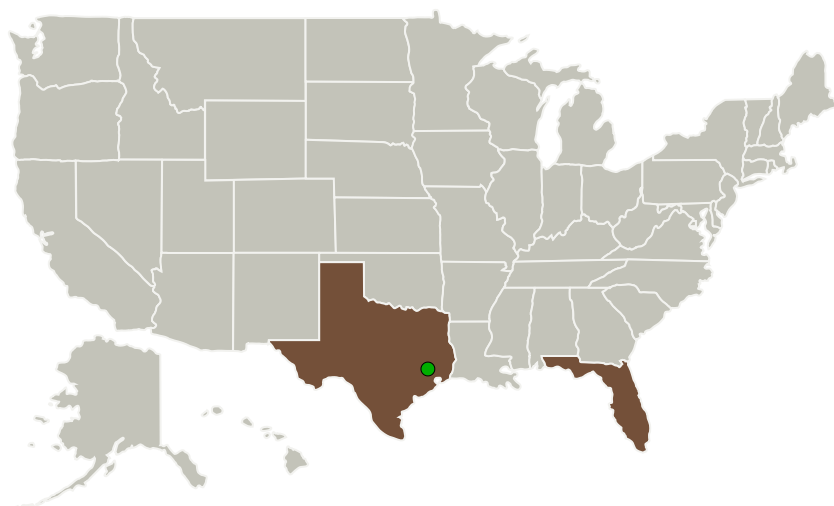
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Dioxide Materials, Inc.	Lead Organization	Industry	Boca Raton, Florida
● Johnson Space Center(JSC)	Supporting Organization	NASA Center	Houston, Texas

Primary U.S. Work Locations

Florida	Texas
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Project Transitions

**July 2018:** Project Start**February 2019:** Closed out**Closeout Documentation:**

- Final Summary Chart(<https://techport.nasa.gov/file/141277>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Dioxide Materials, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Liang Zhu

Co-Investigator:

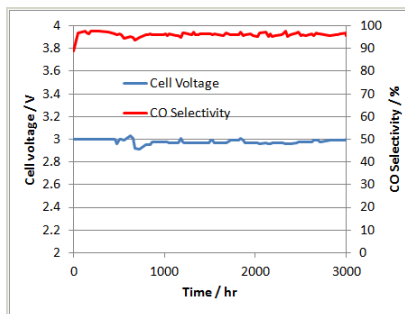
Liang Zhu

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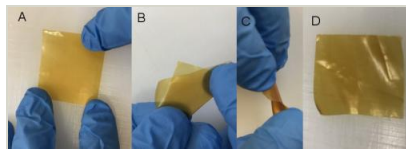
Images



Briefing Chart Image

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(<https://techport.nasa.gov/image/135985>)



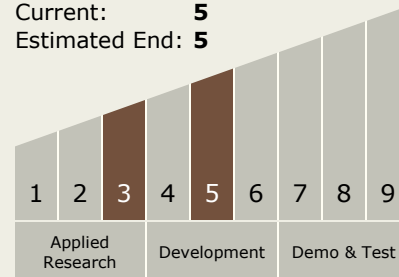
Final Summary Chart Image

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(<https://techport.nasa.gov/image/128577>)

Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX07 Exploration Destination Systems
 - TX07.1 In-Situ Resource Utilization
 - TX07.1.3 Resource Processing for Production of Mission Consumables

Target Destination

Mars